

DECAMETRIC IRREGULARITIES INDUCED BY POWERFUL HF RADIO WAVES IN THE NIGHTSIDE AURORAL IONOSPHERE

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ABSTRACT

One of the prominent phenomena from HF modification experiments is a generation of the artificial field-aligned irregularities (AFAIs) with spatial scales of the order of a few meters across the magnetic field line. New findings in behaviors of the AFAIs in the nightside auroral F region in course of the Tromsø-St. Petersburg ionospheric modification experiments are discussed. Bi-static scatter observations were carried out on the London-Tromsø-St. Petersburg and Pori-Tromsø-St. Petersburg paths using a Doppler spectral method. A principal question related to HF heating experiments is a modification of disturbed auroral ionosphere. Are the heater-induced irregularities masked by natural irregularities or not? The results obtained simultaneously on two diagnostic paths have shown that in some experiments the strong heater-induced field-aligned small-scale irregularities were observed along with natural ones. Velocities of AFAIs were quite different on the Pori-Tromsø-St. Petersburg and London-Tromsø-St. Petersburg paths. The comparison between Doppler velocities from bi-static scatter observations and the ionospheric plasma velocities from the EISCAT UHF radar measurements was made. It was found the qualitative agreement between temporal variations of plasma and Doppler velocities only on the Pori-Tromsø-St. Petersburg path. In our experiments the condition for bi-static scatter was fulfilled for the AFAIs with transverse scales of 10-15 meters. The ray tracing simulation of scattered signals was performed with the radio channel model. Results of simulation revealed that the diagnostic HF radio waves, propagating from the transmitters located at Pori and London, reached the heated volume above Tromsø at the altitudes of 180-200 km and 230-260 km respectively. Moreover backscatter occurs off different, horizontally separated parts of the heated region and they have different horizontal motions. The obtained results have shown the excitation of heater-induced-irregularities in the nightside disturbed auroral F region of the ionosphere observed along with natural ones. Velocities of heater-induced-irregularities were quite different on the Pori-Tromsø-St. Petersburg and London-Tromsø-St. Petersburg paths. The work is supported by INTAS, grant 03-51-5583, and by RFBR, grant 04-05-64160.